TO: David Morris

DATE: October 8, 2002

FROM: Jose Valencia

SUBJECT: Special study of International Gamma Ray Astrophysics Laboratory (INTEGRAL) DSN view periods

REFERENCE: Request by David Morris to perform an INTEGRAL View Period Overlap assessment.

INTRODUCTION

The Resource Allocation Planning and Scheduling Office (RAPSO) has performed a special study to determine if INTEGRAL's request for DSN support will be impacted by DSS-16 Antenna Maintenance, Mars Missions or L1 Halo orbiting missions. An INTEGRAL Goldstone viewperiod with Redu viewperiod ovelaps subtracted was compared to viewperiods associated with SUN and Mars. A refined navigation profile delivered to RAPSO on September 5, 2002 and references October 17, 2002 launch date was used for this study.

ASSESSMENT CRITERIA

INTEGRAL is planned to launch on October 17, 2002. The user is requesting DSS-16 as prime antenna for Launch and Early Orbit Phase (LEOP) and prime mission support. The DSN will supplement ESA's REDU station and provide limited coverage when the spacecraft cannot be viewed from REDU. DSS-24 is planned as backup if DSS-16 cannot provide support.

ASSESSMENT RESULTS

This view period study was performed using an INTEGRAL navigation profile with Redu viewperiod ovelaps subtracted delivered to RAPSO on September 5, 2002. The study covers a two-year period from Week 42, 2002 (launch week) through Week 42, 2004.

INTEGRAL's weekly viewperiod overlap with Mars and SUN viewperiods is illustrated in figure-1. The graph shows that the Sun viewperiods will overlap 90% of INTEGRAL viewperiods during the first 2-weeks of 2003 and 2004. The Sun viewperiods are associated with spacecraft orbiting at Libration Point 1 (LI). In addition, the graph shows that Mars viewperiods will overlap 75% of

INTEGRAL viewperiods during week 17, 2003 and reduce to 0% in weeks 13-28 in 2004.

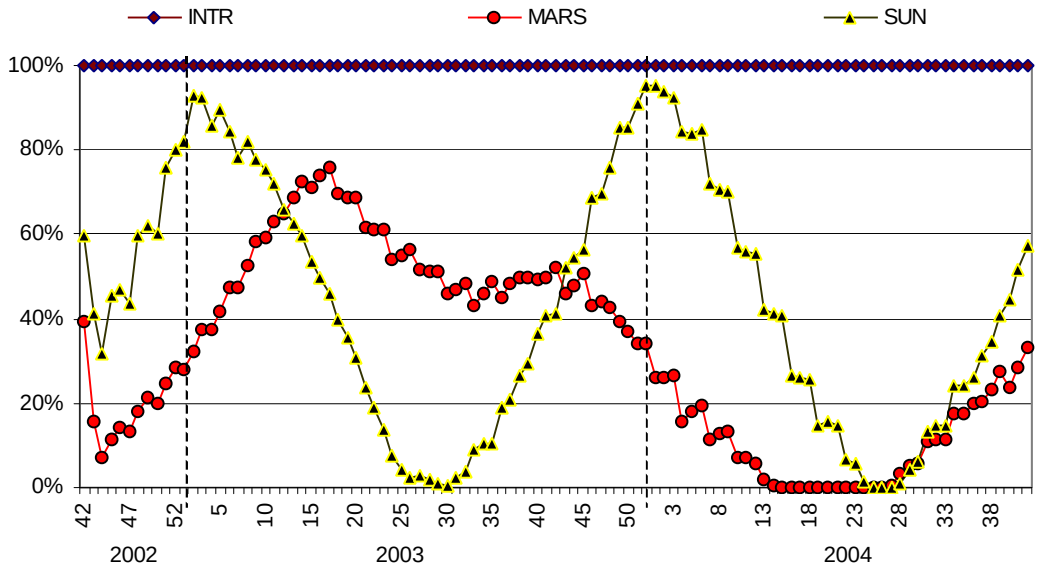

Figure-1: Sun and Mars viewperiod overlap of INTEGRAL

INTEGRAL and Mars viewperiod overlap of DSS-16's weekly maintenance period are shown in figures-2 and 3. Figure-2 shows that INTEGRAL's viewperiod will overlap nearly 100% of DSS-16's maintenance period in week 3, 2003. Mars viewperiod will overlap 100% of DSS-16's maintenance period in weeks 42 and 43 of 2002 and gradually reduce to 0% overlap in week 32, 2003.

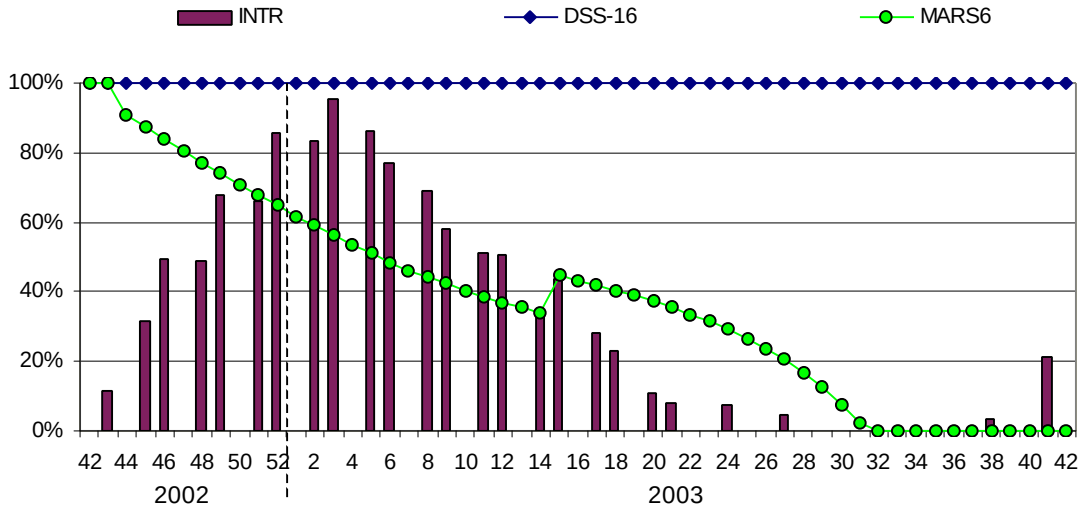

Figure-2: INTEGRAL and Mars viewperiod overlap of DSS-16 maintenance period

Figure-3 shows that INTEGRAL's viewperiods will overlap greater than 80% of DSS-16's maintenance period in week 50, 2003. Beginning in week 43, 2003 Mars viewperiod overlap with DSS-16's weekly maintenance period gradually increases from 0% in late 2003 to 100% in Mid-2004.

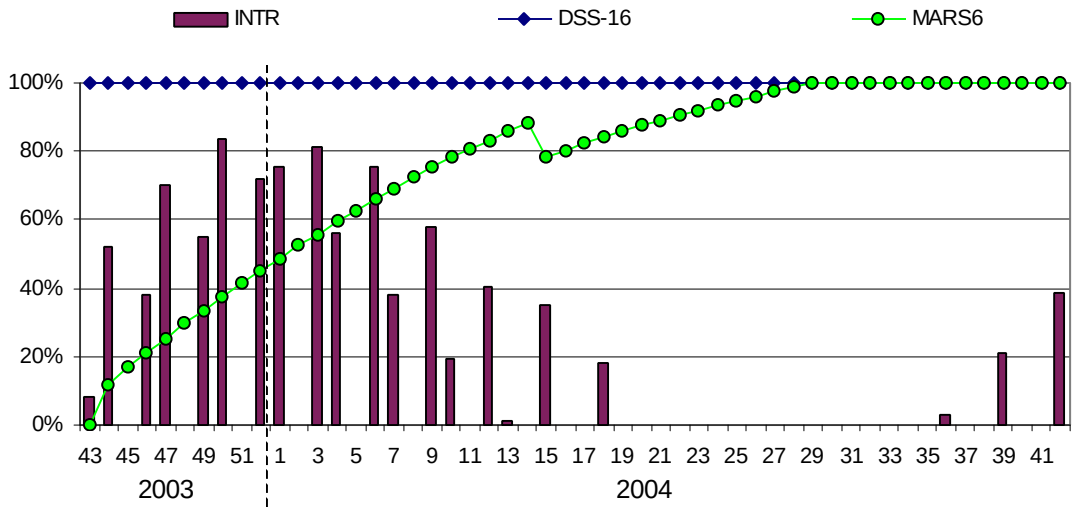

Figure-3: INTEGRAL and Mars viewperiod overlap of DSS-16 maintenance period

In those weeks where INTEGRAL viewperiod overlap is 50% of DSS-16's 8-hour maintenance period the recommendation is to reduce the maintenance period to 4-hours. In those weeks where INTEGRAL's viewperiod overlap is greater than 50% of DSS-16's 8-hour maintenance period the recommendation is to move INTEGRAL support to DSS-24.

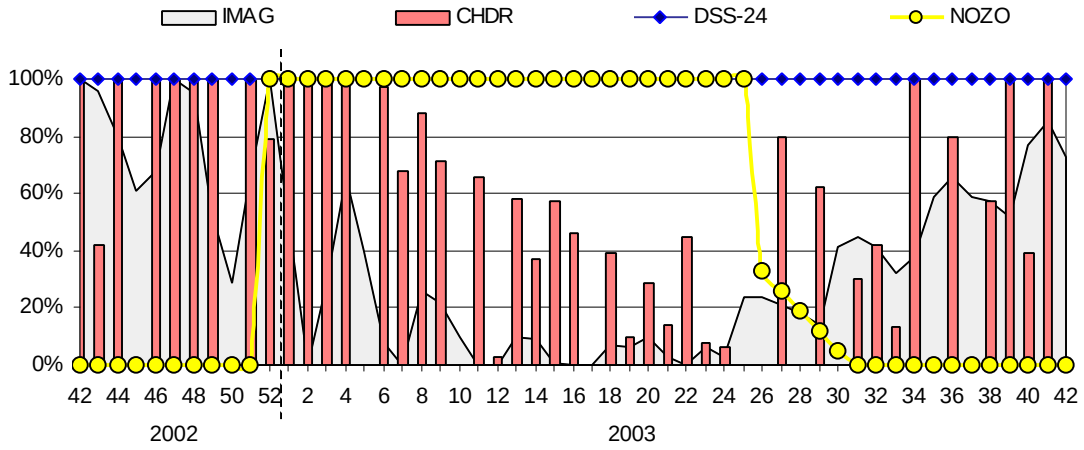

Figure-4: Viewperiod overlaps with DSS-24 maintenance in 2002, 2003

Users of DSS-24 include IMAGE, Chandra, and Nozomi. Figures 4 and 5 show a forecast of their viewperiod overlaps with DSS-24 weekly maintenance from Week 42, 2002 through Week 42, 2004.

Chandra viewperiods overlap 100% with DSS-24 weekly maintenance at regular intervals as illustrated in figures 4, and 5. To minimize contention with antenna maintenance time, Chandra can offload part of its support to DSS-27 (34HSB) and meet its support requirements.

Nozomi viewperiods overlap 100% with DSS-24 weekly maintenance from Week 52, 2002 through Week 25, 2003 as illustrated figure-4. To minimize contention with antenna maintenance time, Nozomi can offload part of its support to DSS-14 and meet its routine support and DDOR requirements.

IMAGE viewperiods overlap 50% or greater with DSS-24 weekly maintenance at regular intervals from week 42, 2002 to Week 50, 2004 as illustrated in figures 4, and 5. IMAGE request for support is approximately 2 hours per day and has minimal impact with antenna maintenance.

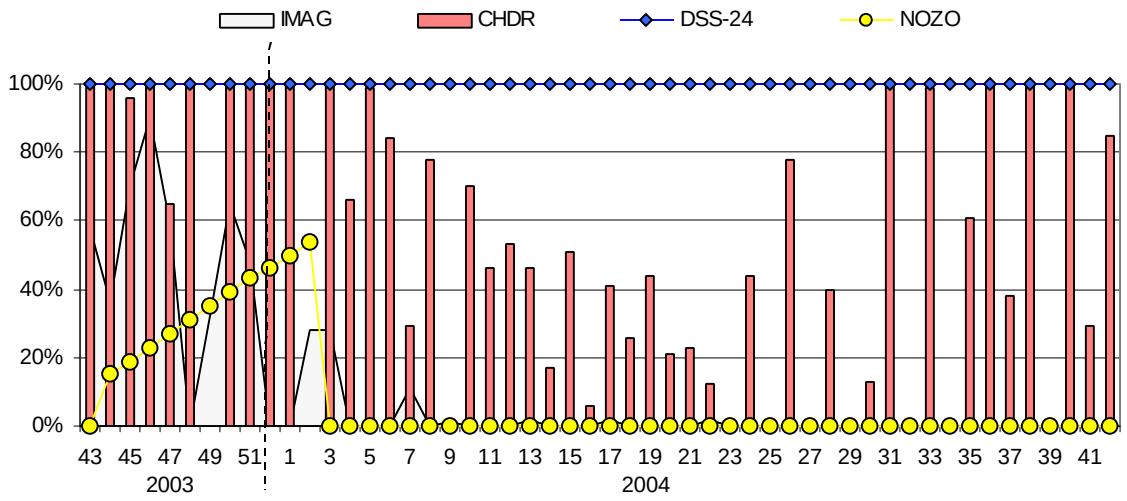

Figure-5: Viewperiod overlaps with DSS-24 maintenance in 2003, 2004

CONCULSION,

The data in figures 2 and 3 shows that INTEGRAL's viewperiod overlaps with DSS-16's maintenance period will at regular intervals exceed 50% throughout the requested DSN Goldstone support period. In those weeks where INTEGRAL overlaps exceed 50% of DSS-16's 8-hour maintenance period the recommendation is to move INTEGRAL support to DSS-24. In those weeks

where INTERGAL Overlap is 50% of DSS-16 maintenance period the recommendation is to reduce maintenance to 4-hours.

Users of DSS-24 include IMAGE, Chandra and NOZO. A forecast of viewperiod overlaps with DSS-24 weekly maintenance are shown in figures 4, and 5. To minimize possible contention with weekly antenna maintenance periods, IMAGE, Chandra and NOZO can offload support to alternate antennas.